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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/827,056	04/03/2001	Chun-Mai Liu	16405-0013	3447

25696 7590 05/09/2002

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EXAMINER	
MAGEE, THOMAS J	
ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 05/09/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/827,056	Applicant(s) LIU ET AL.	
	Examiner Thomas J. Magee	Art Unit 2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1 - 16 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1 - 16 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Elections/Restrictions

1. Applicant's election without traverse of Claims 1 – 16 in Paper No. 4 of March 14, 2002 is acknowledged.

Claim Rejections – 35 U.S.C. 103

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1 -16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (US 6,355,527) in view of Fontana (US 4,823,175) and Sethi (US 5,284,786).

3. Referring to Claim 1, Lin et al. clearly teach a method for forming split-gate flash memories with improved, increased coupling ratio, a silicon substrate, floating gate overlying common source region, ion implantation to form source and drain regions, photoresist patterning for source and gate areas, deposition of polysilicon over oxide, and silicon nitride deposition and patterning to form spacers. Lin et al. do not teach the use of photoresist patterning and ion implantation prior to gate formation. However, Fontana teaches the use of photoresist

masking and ion implantation to form doped regions before gates are formed. Sethi also teaches the formation of doped diffusion regions for source and drain defined by photoresist patterns, followed by floating gate regions. In both cases, the floating gate regions overlap source regions, resulting in high coupling ratios. Therefore, it would have been obvious to one of ordinary skill in the art to include Fontana and Sethi in Lin et al. at the time of the invention.

4. Referring to Claims 2 – 4, Fontana teaches the use of patterned photoresist on nitride for ion implantation masking, followed by removal of the nitride and photo-resist from the surface of the substrate. Although the use of sacrificial oxides is not taught, thin oxide layers are routinely used as blocking (or screening) layers for ion implants and would represent an obvious modification to Lin et al.

5. Referring to Claims 5 – 8, Lin et al. teach a similar method for forming floating gate structures, but do not explicitly identify a conductive layer. Conductive metal layers are well known in the art and it would be obvious to one of ordinary skill in the art to add to Lin et al. to include a specific conductive metal layer.

6. Referring to Claim 9, the use of Boron ions would be an obvious modification to Lin et al., since Boron ions are routinely used in the industry for p-type implants.

7. Referring to Claim 10, Lin et al. teach the formation of ion implanted drain regions, but do not explicitly teach the patterning and etching of a conducting film. Instead, a third, patterned poly-line and spacers at the edge, defining boundaries are used for drain implants. It would be obvious to one of ordinary skill in the art to add a conductive layer to Lin et al. at the time of the invention.

8. Referring to Claim 11, Lin et al. teach the use of a phosphorus implant, where-as, the instant application recites the use of an arsenic ion implant. In both cases, these are n-type implants and produce equivalent results. Therefore it would be obvious to one of ordinary skill in the art to modify Lin et al. to include arsenic implants.

9. Referring to Claim 12, Lin et al. teach the formation of a polysilicon layer at 550 to 600 degrees (C) to thickness between about 1500 to 2500 Angstroms. These are in the range of values recited in the instant application. It has been held that where a general condition of a claim is disclosed in prior art, discovering the optimal or workable ranges involves only routine skill in the art.

10. Referring to Claim 13, Lin et al. teach the formation of a first polysilicon layer using LPCVD with a SiH4 source. Although the instant application does not state

a deposition method, it would be an obvious modification to Lin et al. to include other deposition procedures.

11. Referring to Claim 14, the method of fabricating a flash memory device with high coupling ratio, as recited in the instant application, is anticipated in Lin et al. in view of Fontana and Sethi. The formation of a sacrificial oxide, although not taught by Lin et al. is a commonly used procedure and obvious to one of ordinary skill in the art. Similarly, Lin et al. do not teach the deposition of a specific conductive layer, but metal conductive layers are commonly used and could be routinely added to Lin et al. by one of ordinary skill in the art. Fontana teaches the use of photoresist masking and ion implantation to form implanted regions prior to formation of gate regions. Sethi also teaches the use of doped diffusion regions for source and drain regions prior to gate formation. In each case the floating gate regions overlap source regions, thereby producing an effective increase in coupling ratio. Therefore, it would have been clear to one of ordinary skill in the art at the time of the invention to modify Lin et al. to include Fontana and Sethi.

12. Referring to Claims 15 and 16, it can be noted that the use of ion implantation for adjustment of threshold voltage is a notoriously well known procedure and commonly deployed since the inception of commercial ion implantation

equipment in the industry. It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize ion implantation in Lin et al. for threshold voltage adjustment.

Conclusions

Any inquiry concerning this communication should be addressed to **Thomas Magee**, whose telephone number is **(703) 305- 5396**. The Examiner can normally be reached on Monday through Friday from 8:30AM to 5:00PM. If attempts to reach the Examiner by phone are unsuccessful, the examiner's supervisor, **Tom Thomas**, can be reached on **(703) 308-2772**. The appropriate fax phone number for the organization where this application or proceeding is assigned is **(703) 308-0956**.

Thomas Magee
April 30, 2002

Steven Loke
Primary Examiner